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Contents

Mermaid Mowing Machines

IN recent years biological control has been regaining and perhaps increasing the popularity it possessed before the advent of the synthetic insecticides. The rebirth of interest is due to many factors which have been discussed before.

Despite the fact that one of the earliest and most successful biological control compaigns was the use of Cactoblastis against the prickly pear in Australia, most people think of controlling only insects by biological methods, and the suggestion that animals could be used to control weeds may come as a surprise to them. However it will be nothing to the shock they receive when they hear that someone is suggesting the use of 'mermaids' to control unwanted water weeds.

Yet it has happened for Dr. W. H. L. Allsopp of the Fisheries Laboratories at Georgetown, British Guiana has suggested the use of sirenids (manatees and dugongs) animals which have given rise to more mermaid myths than can be mentioned, for the eradication of undesirable aquatic vegetation. Now before the diehards and traditionalists bust their braces and choke in their boots at this seemingly preposterous suggestion let us examine one or two facts.

First other animals, have on several occasions proved to be extremely useful in water weed control as will be seen from the following quotations*

"The use of ducks is a very effective measure of control against submerged, floating and some emergent weeds. Pekin and Rouen ducks are in this respect apparently superior to Muscovy ducks."

"The tougher floating weeds are taken by ducks as well as the submerged vegetation. In addition young shoots of marginal vegetation are eaten. At higher altitudes, e.g. Eastern Districts, swans may be used instead of ducks."

"Where water lilies (*Nymphaea spp*) have first been cut away *Tilapia melanopleura* will afford a good measure of control if present in even moderate numbers The introduction of even small numbers of this fish will be effective in weed control in time once a population is established. However for rapid results about 500 small fingerlings per acre are needed. 50-100 small fish or about 5 lbs. per acre will ensure control in a year or so provided conditions for survival of the fish are good and one or two breeding pairs per are enough to produce large numbers of fry in a year. Dams in which *T. melanopleura* are sufficiently established will always be free of the softer varieties of weed.

Continued on page 96

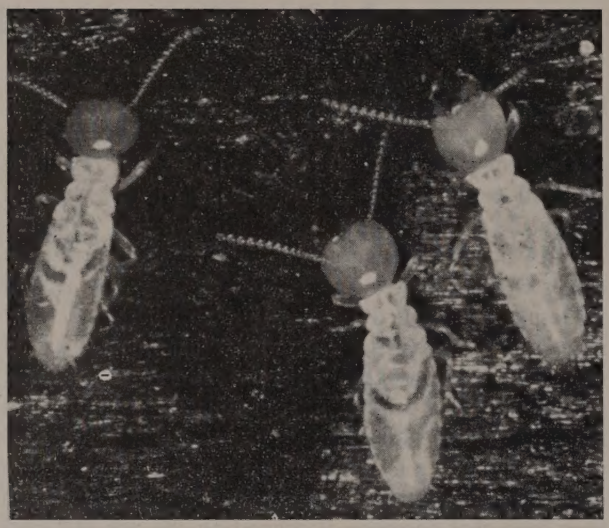


Fig. 1. (Below). Larvae of Reticulitermes lucifugus.

Fig. 2. (Right) A swarm of winged adults of Reticulitermes lucifugus. *For a few minutes only in the whole life cycle, termites actively seek the light—this is when the winged sexuals are freshly emerged.*

MAINTENANCE OF TERMITE COLONIES IN ENGLAND FOR RESEARCH PURPOSES

By N. B. HICKIN, B.Sc., Ph.D.*

RECORDED instances of termite colonies being maintained in England for purposes of demonstration and research are very few. Haviland and Sharp (1896) appear to record the first instance of specially importing and maintaining colonies of termites. A colony of *Cryptotermes domesticus* (Haviland) imported from Singapore was kept in a test-tube 6 inches by $\frac{5}{8}$ inch. It was plugged with occasionally moistened cotton wool, and the termites were fed on a splinter of wood. The colony lived for nearly two years. They were exposed to a wide variation in temperature although they were kept near some hot water pipes. Alates were frequently produced, but were never removed from the tube.

Sweeney (1948) kept a colony only for seven weeks of fifty-two nymphs of *Cryptotermes brevis* Walk. which he had obtained from Chile. He describes an artificial termitarium consisting essentially of a large glass jar in which is fitted an electric light bulb within a metal cylinder in order to obtain the necessary warmth. An apparent serious disadvantage possessed by this apparatus is that the termites are exposed to light. Sweeney states that " the termites thus have little opportunity for concealment " as though this was an advantage. Termites in nature do not expose themselves to light except for a brief period when they possess wings, and it would seem prudent to simulate this condition as closely as possible when keeping termite colonies in captivity.

The room containing the living colonies of termites maintained at the Rentokil Research Laboratories at Felcourt, is one of four specially constructed constant temperature and constant humidity rooms on the first floor of a modern building (1951) converted to entomological research purposes in 1958. A corridor runs the length of the building on the south-east side of the C.T.C.H. rooms. The room was originally designed to hold a large number of cultures of *Lyctus brunneus* and the conditions for a 10—12 week life cycle for the insect are maintained, viz. 25°C. and 75% Relative Humidity. It is probable that these optimum conditions for *Lyctus* are not the most suitable for termites, and the various species of termites are bound to differ in their individual optimum requirements. Heating is carried out by tubular electric heaters, thermostatically controlled. Constant humidity is maintained by a humidistat which controls the humidifying unit from which water is ejected as a fine atomised spray when the relative humidity commences to fall and stops when the required relative humidity has been obtained. This apparatus was supplied by Industrial Equipment Limited. The walls of the room

* *Scientific Director, Rentokil Group.*

are lined with special insulating board supplied by Bowaters Ltd., and half an inch in thickness. All the joints are sealed with a pressure-sensitive adhesive tape, two inches in width and made of polythene.

The dimensions of the termite colony room are 12 feet by 7 feet 6 inches and 7 feet in height. The door is of standard refrigerator pattern, cork insulated and with double rebated frame. The room is normally in complete darkness, but an electric light is present which is switched on only on the room being visited. The conditions of temperature and humidity would normally result in mould formation on the walls and ceilings of the room, but this was prevented by the use of a fungistatic coating. A sealing coat over the insulating board of ' Edsol 33 ' was first applied followed by a good coating of " Dentolite ". These materials were obtained from Denton Edwards paints Ltd. The main contractor for the work described above was A. J. Lake Ltd., of East Grinstead, Sussex.

Colonies of the following species are maintained at Felcourt.

Reticulitermes lucifugus. Nine colonies collected by the writer in France, June 24th, 1959.

Reticulitermes lucifugus var. *santonensis*. Four colonies collected by the writer in France, June 24th, 1959.

The species above are fed on maritime pine, but other timber species have also been introduced, many shelter-tubes have been built over the glass surfaces.

Cryptotermes dudleyi. Two colonies were brought back from Mombasa, Kenya on 16th October 1959, by the writer. Two more colonies were obtained in January 1960. All the colonies are contained within blocks of *Podocarpus* and a number of alates have been produced.

Cryptotermes brevis. Two colonies were collected by Mr. W. J. Holmes in Bermuda, where they were attacking dead Bermuda Cedar (*Juniperus bermudiana*).

Another colony was obtained from an accidental introduction in a portable gramophone case, the details of which have been published elsewhere.

Kalotermes jouteli. This colony was obtained through the kindness of Mr. Victor Harris on May 5th, 1959. It was hoped to subculture another colony from these insects maintained in a Lüscher plate (see Fig. 6) but an attempt with some winged sexuals failed as they did not become established. Small fragments of partially rotted softwoods are used as foodstuff.

Kalotermes flavicollis. Fifteen colonies were brought back from France by the writer on 24th June, 1959. They were infesting vine stocks and the original vine stocks are used as the food materials. These colonies produced many flights during 1959 as follows :

9.10.59	7 alates.	16.10.59	12 alates.
12.10.59	28 alates.	21.10.59	17 alates.
13.10.59	8 alates.	26.10.59	20 alates.
		14.12.59	19 alates.

When alates occur, they are allowed to flutter at a window. Within a few minutes they pair off and the wings are discarded. At this stage the pairs are introduced into fresh pieces of vine stocks in which there are cracks. They quickly disappear into the cracks.

Fig. 3. Queens, kings and eggs of Kalotermes flavicollis.

Fig. 4. Soldier of Kalotermes flavicollis. *Soldiers of Dry Wood Termites are usually present only in low proportions.*

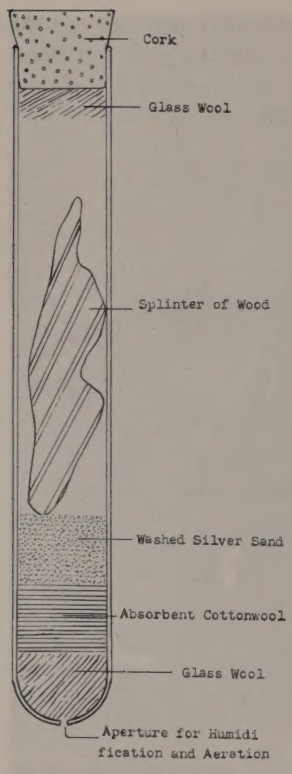
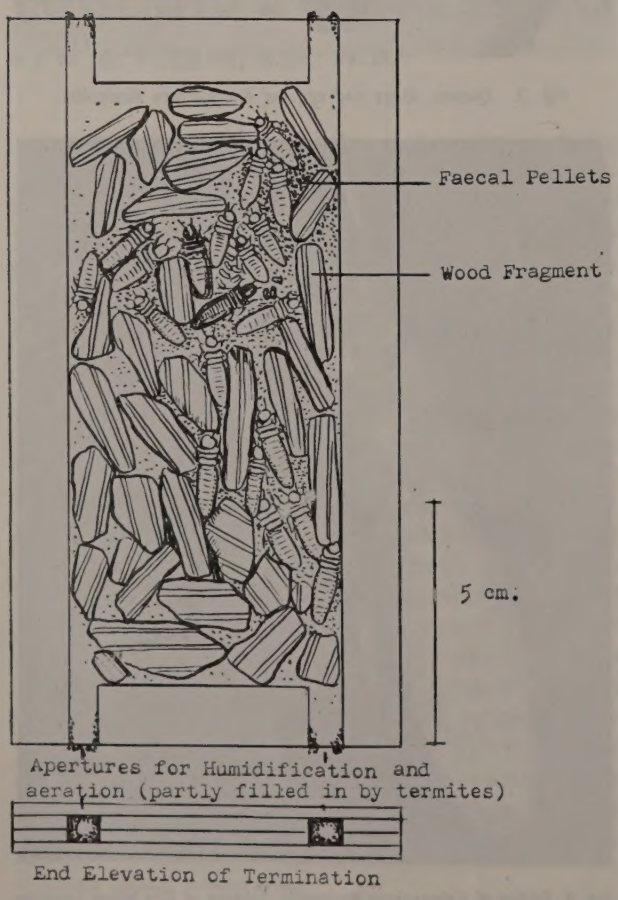


Fig. 5. (left) Jucci-Grasse tube for experimental culture of termite colonies.
(See table for dimensions)

Fig. 6. (below) Luscher plate-type termitarium for experimental culture of termite colonies for observational purposes.



Dimensions of Jucci-Grasse tubes

	Small size	Medium size	Large size
Length	18 cm	25 cm	28 cm
Diameter	17 mm	25 mm	40 mm
Volume	35 cm^3	100 cm^3	300 cm^3
Maximum population	80 individuals	250 individuals	1000 individuals

Colony containers

Three main types of containers for the termite colonies are employed as follows :

1. *Large general receptacle*

These consist of conventional type aquaria of metal strip and glass, and all-glass battery jars.

A most successful colony of *R. lucifugus* var. *santonensis* is contained in a battery jar, 12 inches by 12 inches by 18 inches in height. Glass plates are used to cover the top in each case and a layer of pure washed silver sand is used as a layer to cover the bottom. The cultures of subterranean species are kept moist by damping the sand and spraying the wood as necessary. The tropical drywood termites such as *Cryptotermes* are damped only very occasionally and the blocks of wood containing the colonies do not rest on sand. The temperate drywood termites (*Kalotermes flavicollis*) are damped from time to time, but are not given anything like the amount of water given to the subterranean species, but are given a little more than to *Cryptotermes*.

2. *Jucci—Grassé tube.*

These are of simple test-tube or boiling tube pattern, but a hole is made at the bottom. (See figure 5.)

Buchli has given a table showing the dimensions of three tubes which he uses and the maximum number of individuals in the colonies of *R. lucifugus* var *santonensis* which the tubes would contain, and which would continue to thrive but not increase in numbers.

At Felcourt a few tubes of small and large sizes are maintained. They are damped by placing the bottom of the tube in a beaker of water for a few seconds, when water enters the aperture at the base of the tube it is absorbed by the cotton wool, but care must be taken to see that excess water is not allowed to enter. The object must be to maintain the cotton wool just damp.

3. *Lüscher plate-type termitarium.*

This design of termitarium is better adapted to observational and display purposes than perhaps for experimenting purposes, at least where wood preservation work is in progress. One small colony of *Kalotermes jouteli* is maintained in a termitarium of this type, but has not increased in size over a period of seventeen months. Eggs appear to be laid but disappear.

Acknowledgements

I wish to acknowledge the help of Miss D. Linscott and the staff of the Rentokil Research Laboratory, for their value contribution to this work. In addition I wish to thank Mr. W. V. Harris for his help and advice in setting up this Termite Unit.

Figs. 1, 2, 3 and 4, courtesy Wood Preservation, Ltd.

METAL NAPHTHENATES

By R. BULMAN*

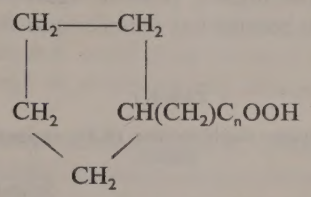
This is the fourth article in the series on the chemical, physical and biocidal properties of the organic solvent type preservatives used for the treatment of timber

The use of metallic naphthenates for wood preservation was first suggested over 70 years ago by Von Wolniewicz[1] and again by Charitschkow[2]. By 1911 wood preservatives based on metallic naphthenates were commercially available in Denmark under the name "Cuprinol". This date not only marking the introduction of metallic naphthenates themselves but also of preservatives known today as the organic solvent type preservatives. It was not until the early thirties, after two decades of experience, that metallic naphthenates were introduced in this country and since then, their development both technical and commercial, has been considerable. Today a wide range of preservatives based on copper and zinc naphthenates and formulated for specific purposes is available.

The metal naphthenates are, as the name implies, the metal soaps (or salts) of naphthenic acids. These acids occur in natural petroleum to varying extents, depending on the source of the crude oil, and although pure naphthenic acids had been isolated nearly a century ago, it was not until the late 1920's that they could be given chemical formulae[3].

The naphthenic acids are now known to be cyclocarboxylic acids of the general formulae $C_nH_{(2n-2)}O_2$

These materials are common to crude petroleum from most sources although the proportions may vary considerably: American crudes contain 0.1% or less whilst Russian petroleums contain 1% and Rumanian oils may contain much more[4]. The acids are extracted by several methods during the course of refining the petroleum, but it has been established that regardless of the source[5] and the method of extraction[6] the naphthenic acids are essentially the same in chemical properties and have the same type of structure as illustrated below.



In making the metal naphthenates, a suitable metal compound can be reacted directly with the naphthenic acid, or alternatively the sodium salt of the naphthenic acid can be prepared, dissolved in water and reacted with a solution of a metal salt; in this latter method an organic solvent such as a petroleum distillate is usually added at the same time so that as soon as it is formed, the metal naphthenate, whilst insoluble in water, dissolves in this organic solvent.

With high quality raw materials, together with a high standard of workmanship, supervision and quality control, a metallic naphthenate of a high degree of purity is obtained as a concentrated solution in an appropriate organic solvent, and this concentrate requires only dilution to the specified concentration to be ready for use Certain large scale consumers can, of course, dilute the concentrates themselves, but the vast majority of users prefer to have the ready-for-use solution available, already carefully diluted to the specified strength under the manufacturer's controlled conditions.

The acids themselves are liquids of varying viscosity and density, of low solubility in water and of low volatility.

Chemically, they are "acidic" in nature but only mildly so and in fact they can be shipped or stored in ordinary mild steel containers; direct reaction with metallic compounds can only be achieved at elevated temperatures. The degree of acidity varies and the function known as the "acid value" is used to characterise the naphthenic acids.

This 'acid value' is the most significant feature of the acids and is defined as "the weight (in milligrammes) of potassium hydroxide which will react and combine with one gram of the acid". It will be seen from the chemical formula that the acid value is inversly proportional to the molecular weight, i.e. the greater the molecular weight, the lower the acid value. In turn

* *Cuprinol Limited.*

the molecular weight will depend on the number '*n*' in the structural formula and also on any other side chains in the cyclopentane ring itself.

The relationship between molecular weight and acid value is given by the following equation, in which the figure '56' occurs as the molecular weight of potassium hydroxide :

$$\text{molecular weight} = \frac{56}{\frac{\text{acid value}}{1{,}000}}$$

From the structural formula itself it will be seen that when '*n*' is zero, the molecular weight is 114 : from the equation, the acid value will, therefore, be 491 — theoretically, the highest possible figure ; likewise, in theory, '*n*' can become any number and the molecular weight can be very high, with a correspondingly very low acid value.

In practice, the acid values encountered are in the range 100—275 (corresponding molecular weights 560—200) whilst the more commonly available acid values range from 180—230 approximately (molecular weights 310—244).

No doubt mention could be made of acid values as low as 50 but in such cases allowance must be made for the fact that unless especially purified naphthenic acids contain a certain proportion of 'neutral' oils. This neutral oil content may be occasionally as high as 20% in normal commercial acid but is generally lower. In the instance of a nominal acid value of 50, the neutral oil content may in fact be as high as 50% so that when the pure naphthenic acid is separated, its true acid value is nearer 100.

Referring now to the formation of a metal salt, one must think in terms of chemical equivalents. Thus, in the equation :

$$\underset{\substack{\text{cupric}\\\text{oxide}}}{CuO} + \underset{\substack{\text{naphthenic}\\\text{acid}}}{2H\bar{N}} \longrightarrow \underset{\substack{\text{copper}\\\text{naphthenate}}}{Cu\bar{N}_2} + H_2O$$

it will be seen that two equivalents of naphthenic acid are required for each molecule of copper oxide, regardless of the molecular weight of the acid. This means that with an acid of lower molecular weight (i.e., high acid value) the copper naphthenate produced also has a low molecular weight even for the same weight of copper.

It is common practice therefore, since the molecular weight varies according to the acid value used, to refer to the 'metal content' of the metal naphthenate as indicative of the working strength of the solution. This is largely a matter of convenience, since the metal content can easily be determined by chemical analysis whereas to find the total naphthenate content would be more complicated.

The chemical and physical properties of the acids

TABLE I.

Solubility of copper naphthenate (9.2% copper) in distilled water.

Temperature - Degrees F.	Solubility Gram/100 Grams Solution
32	.00010
77	.00015
150	.0002
212	.0002

TABLE II.

Vapour pressure of copper naphthenate (9.2% copper)

Temperature - Degrees F.	Vapour pressure mm Hg.
32	0
77	0
100	0
150	0
212	0
280	Negligible - Less than 0.4

TABLE III.

Toxic limits in lbs/cu.ft. of preservative evaluated by the Wood-Block Method *

Chemical	Test Organism			
	Lenzites trabea	*Lentinus lepideus*	*Poria* ** *monticola*	*Coniophora cerebella*
Pentachlorophenol	Between 0.125 and 0.25	Less than 0.125	Less than (2) 0.125	—
Copper naphthenate (calculated as Cu)	About 0.25	About 0.25	About 0.25 (2)	0.1 (3)
Creosote	2	Between 2 and 5	2 (2)	0.32-0.42 (4)
Chloronaphthalenes	—	—	—	0.26 (5)

* *Although the above data were not all obtained by the same wood-block test method the results are based on unweathered blocks and are sufficiently comparable to illustrate the point.*

** (*Poria monticola* is currently accepted as equivalent to *Poria vaporaria.*)

TABLE IV

Toxic limits of 3 fungi for copper naphthenate and pentachlorophenol (lbs./cu.ft.)[9]

Preservative	Fungus		
	Lentinus lepideus	*Coniophora cerebella*	*Polystictus versicolor*
Copper naphthenate (as copper)	about 0.0036	about 0.018	0.036-0.045
Pentachlorophenol	0.030	0.042-0.072	0.078

(*Zinc naphthenate has the same toxicity to* Coniphoria cerebella *as the copper compound and the same as pentachlorophenol to* Polystictus versicolour).

themselves are of little significance ; it is the properties of the metallic soaps which are important in practice.

The copper and zinc compounds are those used in wood preservation ; they vary, depending on the acid value, from somewhat viscous liquids to amorphous 'solids' which areadily liquify on heating. They are soluble in a wide range of organic solvents and have, in fact, infinite solubility in solvents of the white spirit type which are the "carrier solvents" commonly used in practice.

As mentioned above, the metal naphthenates are virtually insoluble in water. Table I shows the data obtained[6] for copper naphthenate itself and from the same source the vapour pressure of copper naphthenate is zero up to the boiling point of water (Table II). These data show the permanence inherent in copper naphthenate treatments.

The electrical properties of copper naphthenate shows that the copper is not present in the elemental (ionic) state and that copper naphthenate serves more as an insulator than as a conductor, hence it can be safely used for preserving telegraph poles and other electrical installations.

Biological Properties

Fungi

It is often asked "Does the naphthenic part of a metal naphthenate contribute to its preservation value ?"

Perhaps the most comprehensive results in this connection are those obtained in Australia[7]. (See Fig. 1). It will be seen that the toxicity of the acids themselves vary with the acid value : the higher the acid value (and the smaller the molecular weight) the greater the toxicity. It should be noted that the acids were obtained from a variety of sources. Also shown in Fig. 1 are the corresponding toxicity data for the copper compounds derived from the various acids used.

The toxicity of the copper compound compared with pentachlorophenol and other preservatives is shown in Table III, obtained by the soil/block method of test[8]. Results by the B.S. wood block test show a similar comparison, though on a substantially different level (Table IV).

Comparison of different soaps by Bulman[9] has shown that in fungicidal properties, copper naphthenate is far superior to the copper derivatives of other acids such as oleic, linoleic and stearic.

Tests by Harkon and Sedziak [10] show in Table V the degree of permanence of copper naphthenate to heating and leaching 'weathering' treatments (1 week at 52°C ; 1 week leaching). From these data, the percentages of the two preservatives remaining are given in TableVI.

Laboratory decay tests on treated samples exposed after they had been through laboratory weathering cycles showed superior decay resistance for the copper naphthenate treatments although samples cut from stakes which had been exposed out of doors for two years, showed little difference between the two preservatives, when subjected to laboratory decay tests[10a].

TABLE V.

Loss of preservative after heating and leaching cycle.

	Volatile Solvent				Heavy Solvent			
Nominal treatment intended (lbs/cu.ft)	0.2	0.1	0.05	0.025	0.2	0.1	0.05	0.025
Actual absorption of copper achieved (before weathering) lbs/cu.ft.	0.257	0.0985	0.0606	0.0303	0.214	0.107	0.0655	0.0360
Copper remaining after weathering lbs./cu.ft	0.203	0.0855	0.0444	0.0273	0.201	0.0930	0.0675	0.0258
Actual absorption of P.C.P. achieved (before weathering) lbs/cu.ft.	0.189	0.114	0.0494	0.0231	0.235	0.118	0.0607	0.0263
P.C.P. remaining after weathering lbs./cu.ft.	0.151	0.100	0.0293	0.0155	0.167	0.081	0.0565	0.0170

TABLE VI

Loss due to heating and leaching (as % of original).

	Volatile Solvent				Heavy Solvent			
Nominal treatment (lbs/cu.ft.)	0.2	0.1	0.05	0.25	0.2	0.1	0.05	0.025
% Copper remaining after weathering cycle	21.0	13.2	26.7	9.9	6.1	4.0	nil	28.4
% P.C.P. remaining after weathering cycle	20.0	12.2	40.8	32.9	30.1	31.3	6.9	35.2

TABLE VII.

Condition of Douglas Fir Stakes (½" x 4" x 18") treated after flueing and exposed for 6 years at the Harrison Experimental Forest, Mississippi[11].

Preservative	Treatment (Note 2)	Absorption lb./cu.ft. Soln:	Absorption lb./cu.ft. Preservative	Condition after 6 years Good %	Condition after 6 years Serviceable %	Condition after 6 years Destroyed %	Average life in years
Creosote	D	1.0	—	—	32.5	67.5	(6) Note 1
	CS	5.3	—	10	80	10	—
	HCS	2.0	—	90	10	—	—
	P	19.6	—	100	—	—	—
Copper naphthenate 2% copper	D	0.4	0.008 Cu.	10	90	—	—
	CS	1.1	0.022 "	50	50	—	—
	HCS	1.2	0.024 "	70	20	10	—
	P	2.9	0.058 "	60	30	10	—
5% Pentachlorophenol solution	D	0.7	0.035 PCP	—	60	40	—
	CS	2.0	0.100 "	—	90	10	—
	HCS	2.1	0.105 "	—	80	20	—
	P	12.5	0.625 "	80	20	—	—
Chromated Zinc Chloride	D		0.03	—	—	100	4.0
	CS		0.35	10	70	20	—
	P		0.62	80	20	—	—
Untreated	—	—	—	—	—	100	3.6

Note 1.—Estimated figure. Note 2.—Key to treatments: D—dip for 10 seconds. HCS—hot soak for 1 hr. cold soak for 1 hr. CS—Cold soak for 24 hrs. P—Pressure.

Outdoor Plywood Stake Tests[11] which included soil contact and where termites were an additional hazard to decay, confirm the good protection given by copper naphthenate as illustrated in Table VII. Against decay only, even dilute solutions gave excellent protection (Table VIII).

TABLE VIII.

Soak and Brush treatments for wood off the ground after nearly 4 years' exposure[12].

Treatment	Preservative solution	*Average Decay Rating (%) after nearly 4 yrs. test
Brush - 2 coats	5% Pentachlorophenol	0.8
	18% Copper Napthenate (2% Copper)	0.3
Soak 30 mins.	5% Pentachlorophenol	0.8
	0.2% Phenyl Mercuric Oleate	1.0
	4.5 Copper Naphthenate (0.5% copper)	0.4
Soak 60 mins.	5% Pentachlorophenol	1.2
Untreated	—	43.5

* *Decay ratings of test units based on decay exposed by longitudinal sawing (0%—completely sound: 100%—completely decayed).*

TABLE IX.

Killing concentrations for *Anobium punctatum* larvae after 12 weeks

Preservatives	Killing Concentrations 100% kill Solution strength %	100% kill lbs. per cu. ft.	80% kill Solution strength %	80% kill lbs. per cu. ft.
Copper naphthenate	6.3 - 10	2.0 - 3.4	<1.6	<0.8
Zinc naphthenate	> 16	> 6.0	1.6 . 2.5	0.75 - 1.06
Pentaclorophenol	> 6.3	> 2.0	<4.0	<1.2
Chloronated hydrocarbons	1.6 - 2.5	0.5 - 1.2	0.63 - 1.0	0.31 - 0.52

Insects

In treatments against furniture beetle (*Anobium punctatum*) a colourless preservative is almost invariably required. The zinc compound is, therefore, the more usual of the naphthenates for this purpose and tests carried out in New Zealand showed that it prevented egg laying and was very effective against larvae transferred to wood treated with it[13].

In Germany, Schulze and Becker[14] also found the naphthenates to be effective (Table IX) although it is unfortunate that their results were not always taken to completion to give the final values both for the 12 week and four week exposure periods.

However, it is clear that zinc naphthenate is comparable with the chloronated hydrocarbon tested, although as with any preservative, it is important that as well as having the direct toxicity to the insects concerned, the preservative should also be satisfactory from other points of view, such as, volatility which can seriously affect the permanence of the preservative in the wood. This, of

TABLE X.

Killing concentrations with respect to House Longhorn larvae after a 4 week period.

Preservatives	Killing Concentrations 100% kill Solution strength %	100% kill lbs per cu. ft.	80% kill Solution strength %	80% kill lbs. per cu. ft.
Copper naphthenate	< 1.6	< 0.8	< 1.6	< 0.8
Zinc naphthenate	1.0—1.6	0.42—0.75	< 1.0	< 0.42
Pentachlorophenol	> 2.5	> 0.8	> 2.5	> 0.8
Chloronated hydrocarbons	0.6—1.0	3.0—0.56	0.4—0.63	0.14—0.31

course, is especially important in eradication work when, apart from an initial high toxicity to kill off the insects and their larvae already present in the wood, permanent components must be present in the preservative in order that protection from future attack will be given for a very long period.

Table X shows the effectiveness of the naphthenates against the House Longhorn Beetle[14]. Again the range of solution strength tested was inadequate to give precise data for direct comparison. However, other tests[15] suggest that copper naphthenate is in fact more toxic than the zinc compound to *Hylotrupes*.

Laboratory tests also show the effectiveness of zinc naphthenate for the eradication of termites[13] whilst outdoor tests[16] show the effectiveness of copper naphthenate, a dilute solution (1.2% copper approx.) applied by only 10 minute immersion treatment protected the timber for two years, whereas without treatment, its life would have been about one week.

Other outdoor tests on a bigger scale[17] show the effectiveness of copper naphthenate in protecting timber for 15 years under such severe conditions of both decay and insect attack and exposure to both ground and weather that untreated controls lasted only one year. In the tests reported in Table VII, termite attack was also present and again shows the protection given by naphthenate treatments.

Similar tests have been carried out in varied conditions in India, U.S.A., Australia, Canada, South Africa, East Africa, West Indies and other parts of the world ; in fact one series of tests has been proceeding in India for a quarter of a century, and other tests of nearly 40 years ago are on record.

Even field tests proceeding for 25 years or more, do not eliminate the need for observation on complete structural entities : structures of natural size carrying out their full functions under normal conditions of weather and any other factor which may arise under " service " conditions but not in laboratory or field tests.

The naphthenates have been in commercial use since 1911—practically half a century, and satisfactory records under actual service conditions have been obtained for all types of structures—from boats to building timbers, poles to cooling towers, the hazards including the normal wood destroying fungi and insects, termites and marine borers.

Solutions of naphthenates

Perhaps the most striking characteristics of the metal naphthenates is their solubility in organic solvents such as benzine, white spirit and other petroleum distillate fractions, a feature first noted at the turn of the century[18]. From this characteristic, coupled with their other fundamental properties arise the advantages[19] which have led to the ever widening usage of these preservatives :—

(a) insolubility in water.

(b) the solutions being based on non-aqueous organic solvents do not cause swelling or distortion of the treated wood. Good penetration by the light oil solvents which can be used, allowing easy application by brushing or dipping.

(c) non toxicity of the preservatives themselves to plant life, making them ideal for use on horticultural timbers.

(d) rapid drying of the carrier solvent allows paintability of the treated wood.

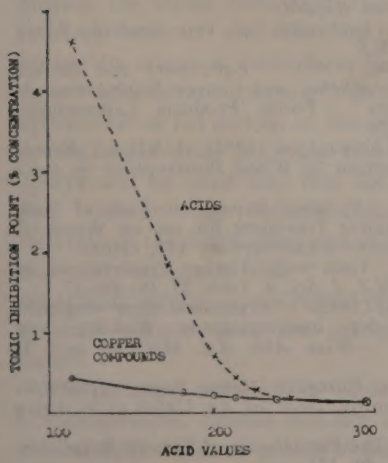


Fig. 1. Toxic inhibition points for naphthenic acids of varying acid value, and their copper compounds. (Test fungus: Polyporous tulipiferous, strain Madison 517).

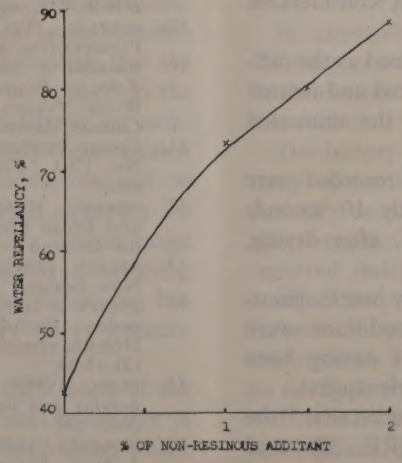


Fig. 2. Increase of water repellancy with increase of non-resinous additant.

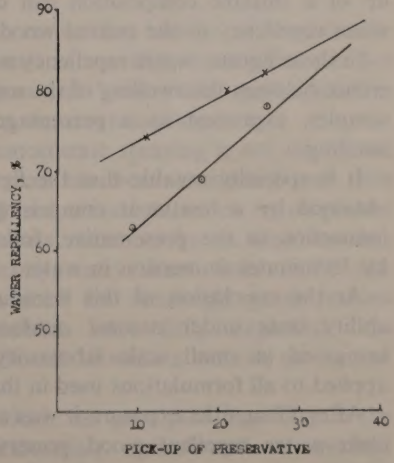


Fig. 3. Effect on water repellancy of "pick up" and type of resin.

The solvent used can be varied according to the method of application and to production schedules, which may require very rapid drying.

Methods of application

The versatility of the metal naphthenates extends to their application ; brushing, spraying, dipping, steeping, hot and cold soaking and even pressure methods can be utilised.

For the last two methods, low priced solvents of low volitility are generally used ; an exception is the " solvent recovery " process[20], a pressure process depending on the carrier solvent being suffiiciently volatile to permit its subsequent recovery for re-use, by vacuum treatment at a suitable temperature.

The other methods of application, being simple to operate and requiring no expensive equipment are, however, the most commonly used. These methods call for the use of volatile solvents which allow the treated wood to be clean to handle and ready for further finishing shortly after treatment.

Research

All the above test results coupled with successful commercial usage for nearly half a century indicate that the naphthenates are effective wood preservatives. Nevertheless, work is constantly proceeding not only from an academic point of view, towards finding out more and more about the " *modus operandi* " of metal naphthenates, but also towards improvements of formulations from other points of view.

Thus, whilst it is well known that naphthenates themselves impart a substantial degree of water repellency to treated timber, work carried out in 1955[18] gave the results shown in the graphs below (Fig. 2 and Fig.3). These bring out the " natural " water repellency of the metal naphthenates, and show also how a relatively small pick up of a suitable composition can confer considerable water repellency to the treated wood.

In these figures, water repellency is defined as the difference between the swelling of the untreated and treated samples, expressed as a percentage of the untreated swelling.

It is specially notable that the figures recorded were obtained by a treatment comprising only 10 seconds immersion in the preservative, followed, after drying, by 30 minutes immersion in water.

At the conclusion of this introductory work, paintability tests under natural outdoor conditions were instigated (a small scale laboratory test having been applied to all formulations used in the early stages).

After 17 months exposure it was concluded that " the clear water repellent wood preserver (RE. 37) used under a 3 coat paint system gives at least as good durability as the same paint system on untreated wood ".

This description of the work done in developing a product with additional properties is included here to show that such projects are undertaken seriously, and that long term testing is still not outmoded.

This review might well be concluded by observing that whilst naphthenates themselves are eminently suited by virtue of their ease of application and properties for many purposes, the possibility of improving their performance is constantly under review both by attention to the raw materials and by admixture with other chemicals.

Thus, in the field of woodworm eradication, whilst naphthenates (generally the zinc naphthenate because it is colourless) forms an excellent basis to insecticidal formulations, especially because of its non volatility, other materials can easily be added to give additional properties as required in this particular field.

The review would not, however, be complete without mention of specifications, more detailed reference having been made previously[12] let it suffice to say here that after some 50 years commercial usage, standard specifications are now being drawn up in this country. Perhaps this is a measure of the conservative approach in the all important field of preservation.

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DEVELOPMENT OF CONCENTRATE SPRAYING

Part I
History – pre 1940

By J. G. ROSE, B.Sc., F.R.E.S.

In the first of this series of articles, the author reviews the history of the development of the concentrate spraying technique, examines certain aspects of the subject and summarises the progress made after ten years of practical experience.

The term concentrate spraying has never been defined to everyone's satisfaction although in Great Britain the more influential chemical manufacturers, research stations and the machinery manufacturers appear by common consent, to have accepted, that the term "concentrate spraying" should be applied to the application of ten gallons or less of total spray per acre, at the same time implying that highly concentrated sprays will be used and that the atomisation will be fine. Moore[1] has defined concentrate spraying as referring to the diminishing end of the low volume range and adds succinctly that " . . . concentrate spraying necessarily implies some degree of reduced volume, but reduced volume does not necessarily imply concentrate ".

The accepted definition in Great Britain, parts of the Commonwealth, France and her overseas associates is substantially the same as that of the United States where one authority[2] has defined concentrate application as having three necessary characteristics, (i) the application of a low volume ($\frac{1}{4}$ - 15 gallons) of total spray per acre, (ii) a concentration of pesticide many times that of any dilute mixture of the same pesticide, (iii) fine atomisation compared to that for dilute sprays, most of the spray volume being in drops less than 300 microns in diameter. The difference lies in what is considered to be fine atomisation. Outside the U.S.A. atomisation providing a volume median diameter of approximately 100 microns when using water based materials is considered to be desirable under most conditions. Although the quality of atomisation is recognised by many to be of fundamental importance, very few machines labelled concentrate sprayers which are in use today are capable to providing the desired atomisation.

To save confusion this series of articles will deal with the development of spraying at less than ten gallons of total spray liquid per acre.

A horse-drawn ground crop version of the 'Strawsoniser'
Photo courtesy The Strawson Chemical Co.

Early History

In attempting to write the history of concentrate spraying, one is forced to consider systems that are not in themselves 'concentrate' but which participated in the evolution of the concentrate idea.

The history of concentrate spraying is not the classic story of an idea that has been conceived and then patiently developed and refined to widen its scope and effectiveness. It seems rather to be an idea that has occurred independently many times, later to be discounted and abandoned for seemingly good reasons before its potentialities were fully exploited. In consequence it is difficult to write a smooth account of its development.

The basic urge which has prompted ingenuity in the development of industrial, agricultural or medical spraying equipment has been the desire to reduce the vast quantity of diluent liquids that were previously required in order to obtain an even distribution of active

material over a given area. Theoretically a reduction of the inert diluent should offer both economical and practical advantages. Less effort, lower cost, more speed and sometimes even a saving in dose of active material, ought to be the consequence of eliminating much of the carrier fluid.

In order to distribute a few gallons of liquid over a large area satisfactorily it must be finely atomised, and the history of concentrate spraying is in a sense the history of refinements in atomising devices.

A search through the 'Hydraulics' catalogue[3] at the Patents Office in London from the year 1617 revealed the first official mention of a refined atomising device.

Air Blasts and Air Streams

On April 28th 1859 William Alonzo Tompson filed his patent No. 1073 entitled 'Improvements in apparatus for applying liquids to the throat and air passages for medical purposes'. Tompson's improvements consist of a gas chamber holding air under pressure; this is connected with a vessel, usually filled with a solution of nitrate of silver; this vessel contains a piece of glass rod, with a number of capillary passages through it; "One end of this rod dips into the liquid, while the other rises above it. The air, in entering, impinges or presses on the surface of the liquid and forces it through the passages in the rod; it is thus brought within range of the current of air, and is carried by it through the escape tube or jet; at the end of this tube there is a covering of very fine gauze of silver wire, through which the solution can escape to the throat only in an extremely divided state".

Since Tompson's patent was granted it can be inferred that his apparatus was the first version of what we now call a 'high speed air jet' to be produced in the United Kingdom.

It is possible that prior to 1859 in Europe or the U.S.A. either a spinning disc or a high speed air jet had been used to atomise liquid but it seems unlikely since the second half of the 19th century was an epoch of wide travel and dissemination of knowledge has become relatively rapid and simple. It would seem pointless for Tompson to patent his apparatus if it already existed. There appears to be a desperate anxiety in our age to establish the paternity of ideas and if Tompson, a worker in the field of medicine, cannot genuinely be called the father of concentrate spraying in pest control he certainly ought to be considered as one of the foster parents.

Twenty seven years elapsed between the filing of Tompson's patent and the publication[4] in Paris in 1886 of details of a piece of equipment that had been designed to distribute Bordeaux Mixture. This machine, the Audebert pneumatic sprayer, consisted of a tank strapped to the operator's back feeding liquid, under gravity, through a thin rubber tube into the discharge end of a pair of bellows. As the liquid dripped into the air stream created by the bellows it was atomised and projected towards the crop. This type of atomisation must of necessity have been fairly crude but the apparatus could certainly be called the forerunner of the modern airblast atomiser which is incorporated into a good many low volume sprayers. In France the 1880's were years of great activity for the inventors of spraying equipment. All manner of contraptions were patented following Millardet's startling discovery of the fungicidal properties of Bordeaux Mixture in 1882. At last the vinegrower had a product to control the mildew that was robbing him of his crop and machines had to be invented for its distribution.

The First Rotary Brush

From the point of view of concentrate spraying one of the most interesting of this crop of machines was invented in 1887 by Casenave. Described by Large[5] in 'The Advance of the Fungi' it consisted of a cylindrical brush mounted on a central shaft. The brush could be rotated by turning a cranked handle attached to one end of the brush shaft. The shaft bearings were attached to the sides of a liquid trough in such a way that at least half of the brush would be below the surface of liquid when the trough was full. Directly above the shaft just making contact with the bristles of the brush was a flat scraper bar. As the brush was rotated it picked up spray from the trough which was then flicked away from the operator in droplets as the bristles were released from scraper bar. Casenave's machine was a forerunner of the rotary brush developed later for aerial spraying. Whereas the rotary brush depends upon the speed of rotation of the entire brush for the formation of ligaments of liquid and subsequently droplets, Casenave relied upon the great speed achieved by the tip of the bristle in its flick from the scraper through a segment of a circle.

The Strawsoniser

A year later G. F. Strawson[6] produced what he called his 'Strawsoniser'. At the Paris Exposition of 1889 the Strawsoniser was awarded a gold medal and it also received the highest award at the Royal Show at Windsor. This machine provoked great interest and was exported to many parts of the world including the U.S.A.

The Strawsoniser was trailer mounted and consisted of a tank from which spray was fed to a battery of high speed air jets, air being provided by a compressor driven off the main axle of the land wheels. The battery of jets could be orientated to enable ground or tree crops to be treated. The machine was advertised as being suitable for draught by horses, mules, oxen, etc.

Strawson's machine ultimately lost popularity since there were so few materials suitably formulated for atomisation by high speed air jets. Another reason why the machine fell out of use was that although the jets produced excellent droplets Strawson made no provision for a strong airstream to carry the droplets any distance. For its effect the machine had to rely almost wholly on haphazard drift which meant that it had to be used under the rarely attainable ' flat calm atmospheric ' conditions

It is alarming to reflect that by 1888 Strawson had developed a good half of what could be considered a useful, genuine concentrate sprayer. If he had provided an effective airstream the whole of our outlook on plant protection over the past 70 years would have been very different.

Little of great significance in the history of concentrate spraying appears to have occurred between the development of the Strawsoniser in 1888 and the discovery of the pulse jet in 1908 by Karavodine[7]. Working in Germany, Karavodine found that firing a combustible charge within a tube produced a sudden localised pressure rise which expressed itself in a series of waves throughout the mass. Between each pressure rise there was a pressure drop. The frequency of the cycle depended on the shape, diameter and length of the tube. Supplying a valve to close one end resulted in the gases being expelled from the open end of the tube in a pulsating stream under the influence of the initial pressure rise.

This discovery of Karavodine was accepted as an interesting experiment but no further attempt was made to develop the pulse jet until 1928, when Paul Schmidt[7] carried out further experiments and took out patents in 1931. Out of this work, developed intensively during the war, sprang one of the thermal fog generators used today.

Liqui Duster to Speed Sprayer

In 1925[8], the Rex Company of Rochester, New York brought out their Liqui Duster, which was later purchased and marketed by the Niagara Sprayer and Chemical Company. This machine anticipated by several years the application of liquid in an air blast. The air blast was conducted through a flexible tube at the end of which was a centrally mounted nozzle. The spray was injected into the airstream which aided atomisation and helped carry the material to the foliage. Designed primarily for orchard work the low volume and velocity of the airstream made the task of obtaining good cover difficult. Greatly improved high pressure hydraulic sprayers came onto the market about this time and the Rex Liqui Duster could not compete with them in practice.

In 1928, Potts[2] began experimenting with the idea of applying highly concentrate sprays in finely atomised droplets. In the beginning the oil spray was atomised into the four inch outlet discharge pipe of an orchard duster, but, as was the case with the Rex Liqui Duster, the inadequate air volume and velocity limited the projection of the spray.

Parker[9] in 1931, using a machine known as Vapo-Duster, applied finely atomised oil for the control of the grape leaf hopper. The machine consisted essentially of a preliminary hydraulic pressure type nozzle which atomised oil into an airstream which in turn was responsible for a secondary atomisation and for transporting the droplets towards the target.

By this time several liquid pyrethrum formulations had become available and their development initiated a re-appraisal of the dormant Strawson method of spraying. Pyrethrins in oil were applied to fruit and vegetable crops through Strawsonisers and even today it is possible to find some of these early machines being used for the same purpose.

In 1934[8] an American worker, French, published a description of an air blast machine specifically designed for applying finely atomised oil. He recognised the importance of the effect of the relationship between air velocity and liquid feed characteristic in the size of droplets produced and understood the importance of droplet size. On reflection it is alarming to find that over a quarter of a century ago people like French realised the importance of droplet size for successful ultra low volume spraying when even today the majority of the world's crop protection advisors seem to be unaware of its importance and incapable of correctly assessing a droplet spectum.

G. W. Daugherty[8] in the United States is credited with producing the first successful large airblast dilute sprayer. This equipment was first used in Florida citrus groves in 1937. The spraying unit contained a four bladed aircraft propellor delivering a large volume of high pressure air through an outlet which fomed a wide arc. Disposed round the periphery of the arc were nozzles which injected atomised liquid into the airstream where a secondary atomisation took place. Later an axial flow fan was substituted for the aircraft propellor and the machine became famous as the Speed Sprayer.

Aerial Spraying

Practically all spraying by aircraft can be considered as concentrate spraying since power/weight considerations make ultra low volume applications desirable.

The earliest experiments in aircraft spraying that have been recorded were carried out in Russia in 1922.[10] A simple spray boom equipped with Vermorel nozzles fed by pressure from a windmill driven pump was used in these experiments. The insecticides of most value at this time were largely insoluble arsenical compounds

Since these materials were not ideally suited to boom and nozzle application through fine apertures, dusting was favoured and the early aerial spraying experiments did not lead to a rapid acceptance of this technique in practice.

1929 saw the beginning of series of tests[2] using aircraft made available through the Massachussets Institute of Technology. As the result of these studies a satisfactory aircraft boom with hydraulic nozzles was developed but as was the case with the earlier Russian equipment little use was made of it due to the nature of the chemicals then available.

Herbert[11] reports the first use of a rotary brush attachment to aircraft. In 1932 kerosene was applied through this type of equipment for the control of mosquito larvae. This work was later extended to the application of oil emulsions to orchards and vineyards. The rotary brush consists essentially of a core to which bristles are attached radially. The whole apparatus driven by a windmill, rotates during flight. Liquid is fed to the core and then conveyed by centrifugal force to the tips of the bristles where it forms ligaments which ultimately break up into fine droplets. Despite distinct limitations the rotary brush was a very important development in the history of concentrate spraying since it represents the first real attempt to produce for aircraft attachment a precise piece of apparatus capable of controlled atomisation.

Summary

Although it appears at first sight that concentrate spraying is a modern conception developed during the last decade, a little delving into the history of the subject shows that many of the basic ideas and attempts to put them to practical application were first mooted many years ago. Development was, however, sporadic and haphazard. As we shall see from the articles to follow, it continues to be so although the principles of concentrate spraying are beginning to be understood and appreciated.

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Mermaid Mowing Machines *(Continued from page 83)*

"*T. mossambica* is very effective in controlling the filamentous algae and indeed in ponds where there are large numbers of these fish weeds will not return having once been eradicated."

The manatee (*Trichechus manatus*) has a voracious appetite especially for grasses and in one experiment two manatees each about seven foot long cleared weeds from a canal 22 ft. wide and nearly a mile in length in some 17 weeks.

Unfortunately, the sirenids are not particularly numerous the manatees being confined to tropical rivers of Africa and America while the dugong is mainly found only in the Indian Ocean.

There are three main reasons why it may be well worth while investigating the use of these fascinating mammals for weed control.

(1) It may be possible to persuade them to eat the water hyacinth *Eichhornia* which is a serious weed problem and is at the moment strangling many large tropical rivers and *Salvinia spp.* which also are difficult to control by other means.

(2) Food. Ducks have been used for water weed control. Have you tasted duck with apricot stuffing ? ! Where ponds and dams etc. are stocked with fish the primary object has not usually been to provide a method of controlling weeds but to provide the neighbouring territory with a valuable source of protein. The manatee is considered, in British Guiana at least, as a rare delicacy. Indeed in certain instances the use of manatees to control weeds though contemplated was ruled out because it would be impossible to prevent poaching. If these sea cows could be bred in sufficiently large numbers (more or less domesticated) they could in addition to controlling weeds also provide a valuable addition to the protein deficient diets of several tropical countries.

(3) Purely aesthetic reasons.—the sirenids are a most interesting and unusual group of mammals which is unfortunately becoming small in numbers and using them to control water weeds could well prevent yet another interesting creature from becoming extinct.

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* Van der Lingen *et al* (Sept. 1960) "Weed Control in Dams and Irrigation Channels." *Rhodesia Agric. J.* **57**(5), 354.

NEWS AND NOTES

New Name For Pest Control Organisation

As from December 1st Europe's largest and most comprehensive pest control organisation will operate under a different although very familiar name. The thirty-two year-old- British Ratin Co. Ltd. will now be known as Rentokil Group Ltd., thus developing the use of the well-known name which was acquired in a merger a few years ago.

In recent years the organisation has been referred to as the British Ratin Group, and has embraced some ten different companies. Within the new Rentokil Group the number of individual main operating companies will be reduced and at present they will consist of Disinfestation Ltd., Rentokil Ltd., Woodworm and Dry Rot Control Ltd. and Wood Preservation Ltd. However, another new company in the woodworm field is to be launched in the New Year.

Last year, Insecta Laboratories Ltd., Scientex Ltd. and Agricultural and Industrial Coatings Ltd. joined the Group, and the activities of these companies, together with Fumigation Services Ltd., are now combined with Disinfestation Ltd. Another company, Mi-Dox Ltd., will become a division of the Rentokil products company.

The Rentokil Group provides services for the preservation of timber, control of rodents and insects, marine disinfestation, a hygienic service for the broiler industry, industrial weed control, and bird control on public buildings; while its products include timber preservation fluids, wood dyes, insecticidal furniture polish, garden insecticides, mothproofer, aerosols, bird repellents, fruit sprays, and farm, orchard and pre-packing machinery.

Recent developments have included new methods of controlling house flies, a delayed action wasp control technique, long-lasting insecticidal resins, bird repellents which have been used successfully in Trafalgar Square, a woodworm and dry rot service which backs its work with a 20-year guarantee, an industrial weed control service which has been taken up by electricity authorities and oil refineries. Other new developments are promised for the New Year.

In addition, termite control has been developed overseas, a new company — Rentokil Pest Control (East Africa) Ltd. — has offices in Nairobi and Mombasa, Rentokil products are on sale throughout the world, fumigation equipment has been sold to several countries and two of the company's preparations are now being made under license in the U.S.A. Continental activities are operated by subsidiary companies centred on The Hague, Holland.

In the United Kingdom, where there are branch offices in almost every principal city and large town, the Group gains considerable prestige from its well-known Woodworm and Dry Rot and Pest Advisory Centres.

Cash Awards To Designers Of Humane Traps

The Humane Traps Monetary Awards Panel is now ready to consider applications for awards from inventors whose original designs have led to the development of humane traps. Applications for awards should be made on a form obtainable from the Secretary, Humane Traps Monetary Awards Panel, Ministry of Agriculture, Fisheries and Food, Government Buildings, Block 'B', Hook Rise, Tolworth, Surbiton, Surrey.

The Panel will consider applications from inventors whose traps are already on sale and from those who are in process of developing new designs or improvements.

New Industrial Biological Research Association

A new research organisation—the British Industrial Biological Research Association—has been formed to study the possible effects upon health and to ensure the harmlessness of substances which may be ingested in food, drink and cosmetics. Supported by a number of leading companies in the food, chemical, essences, plastics, packaging and cosmetics industries, together with certain important distributive concerns, it is welcomed by interested Government Departments and will receive a grant from the Department of Scientific and Industrial Research. It becomes the 52nd Research Association to join the Government Scheme.

The Association's main object is the establishment of a biological research station for investigating the effect of the many substances used in food manufacture, either as processing aids or for flavouring and colouring food, as well as those which may get into food from pesticides, from plant used in food manufacture, from packaging materials, or from utensils. Although some of the larger companies in the food and chemical industries have their own research facilities, until now there has been no national industrial organisation in this country with responsibilitiy for work of this kind.

There is a lack of data on the effect of these substances on health, particularly when they are ingested in small quantities over a long period of time. Further development of test methods using experimental animals is also needed. Results of related research in other establishments throughout the world will be studied and interpreted for members as part of an advistory and information service.

Firm undertakings of support, for a total sum of approximately £23,000 a year for the first five years, have already been given by 90 individual companies. In addition the D.S.I.R. has agreed to match the industrial subscription £1 for £1 up to a total grant of £47,000 a year. While this is in excess of the income at present guaranteed by industry it reflects the Research Association's own confident expectations of further industrial support.

The Association hopes to build its laboratories at Leatherhead, Surrey, on land leased from the British Food Manufacturing Industries Research Association, which has offered to share some facilities and administrative services in the initial stages. Subject to the satisfactory conclusion of negotiations, most of the buildings should be completed by the end of 1961 and the research station should be fully operative by mid-1962. The estimated capital cost is £56,000.

The Research Association will be electing its Council in the very near future, after which the appointment

of a Director of Research will be considered.

The temporary headquarters of the British Industrial Biological Research Association Ltd. are at 11, Green Street, London, W.1. (Telephone MAYfair 8971).

Seminar on Communicable Disease

A Veterinary Public Health Seminar was held in Nairobi from 24th November to 3rd December, 1960. It was organised jointly by the Commission for Technical Co-operation in Africa South of the Sahara (CCTA), the World Health Organization (WHO), and the Food and Agricultural Organization of the United Nations (FAO).

The meeting was concerned with the public health aspect of veterinary problems, such as the diseases of animals communicable to humans through meat, milk and other food stuffs. It provided an opportunity for the leading experts working in Africa to exchange information and experience on these diseases with a view to establishing the best methods of tackling them and of using such assistance as may be available for this purpose from international bodies.

Duke visits Dow

On the 18th November H.R.H The Duke of Edinburgh officially set in operation the Dowpon plant of Dow Agrochemicals' new King's Lynn factory. During his visit the Duke was shown round the offices, research laboratories and chemical plant. He was also shown a special exhibition of grass control by Dowpon and warble fly control with Etrolene. He appeared to be particularly interested in a radio tracer technique to follow the translocation of herbicides through plants.

The Duke was accompanied on his tour of the chemical plant and the magnificent, palatial, administrative and research block by Dr. W. E. Ripper, Managing Director, Dow Agrochemicals Ltd., Mr. C. B. Branch, President, Dow International S.A., Mr. J. W. Britton, Mr. C. Robertson and Sir Norman Hulbert, M.P., Directors of Dow Agrochemicals, and Dr. E. K. Woodford, Director of the ARC, Weed Control Research Organisation, Oxford.

Fibres for Farmers

Plastics and synthetic fibres is probably the most rapidly expanding technology of today with the polymer scientist making new discoveries at a bewildering pace. A pace perhaps only matched by the rate at which the marketing organisations invade further fields of use for these materials.

Industry is of course well aquainted with these products and their vast potential, now Northide Ltd., George Street, Hyde, Cheshire, are entering the agricultural market with PVC/nylon reinforced sheets for the protection of hayricks and stacked products.

These Nylon/PVC sheets are rapidly replacing conventional tarpaulins, being lighter, easier to store and rot proof and have previously been used as fire brigade salvage sheets, barge covers and for covering sports grounds, etc. They are also stated to be satisfactory for fumigation purposes as they are resistant to most chemicals.

Wormwood Woodworm Service

Richardson & Starling Ltd., whose research laboratories at Winchester are stated to have contributed significantly towards modern methods of controlling wood destroying organisms have acquired new premises in the City of London at 21, Wormwood Street, Bishopsgate, E.C.2.

The premises, which were opened on 2nd January, 1961, will be used as a Timber Decay Advice Bureau where expert guidance on the treatment of timber decay in all kinds of buildings from churches to cooling towers, factories to farms and also boats will be freely available to architects, engineers, surveyors or anyone with a timber deterioration problem.

Advice on the treatment of new building timber by vacuum-pressure impregnation will be given with the assistance of technical experts from Hickson's Timber Impregnation Co. (G.B.) Limited. Also available will be information on glass fibre/resin methods of building and cladding boats, caravans, etc., evolved by Norfibre Limited of Norwich.

Plant "antibiotic"

It is reported from Australia that a team of scientists of the Division of Plant Industry C.S.I.R.O. have recently discovered — isolated may be a better word — an anti-fungal substance in peas. This substance, which has been named 'Pisatin', is described as the first plant equivalent of the mammalian antibody.

It has been said that now the chemistry of this, the first natural plant disease-resistance substance, is known, a new field of research has been opened whereby it may be possible to produce chemicals similar to Pisatin that could be used to spray plants to protect them from fungus diseases in the same manner that antibiotics protect humans and animals from bacterial diseases.

According to Mr. J. H. E. Mackay, Assistant Technical Secretary, Division of Plant Industry, C.S.I.R.O., Canberra, Pisatin is a phytoalexine as postulated by Muller to be produced by hypersensitive or some resistant species in response to fungal infection.

To provide Pisatin for experimental purposes a technique has been devised whereby pea pods are inoculated with *Monilina fructicola*, the organism causing brown rot of stone fruit, and following an appropriate incubation period the active material is extracted.

Although it is probable that

Maritime situation and aspect are plainly seen in this view of the new Administrative and Research Block of Dow Agrochemicals Ltd., on the bank of the Great Ouse River at King's Lynn.

similar substances are produced in other instances where hypersensitive reaction to infection occurs the combination of peas and brown rot was chosen as a convenient research tool for phytoalexine investigations since extractable quantities of active material are produced in reasonable time; even so, the amount produced is small so that to date no detailed investigations of disease control by this material have been undertaken.

New Packing Case

Reed Corrugated Cases Limited is now marketing a new non-returnable corrugated fibreboard clad polythene container, designed for the carriage of a wide range of products in liquid and loose powder form.

The new product is a composite container in which the corrosion-resistant polythene inner vessel is held in a specially designed patented carrier of corrugated fibre-board complete with separate carrying and pouring grips. The whole unit is fitted into a normal one-piece fibre-board outer transit case.

The polythene vessel is manufactured by the new company, Reed Plastic Packaging Limited, and is a light-weight, thin walled vessel of one-piece seamless construction. Its integral screw-necked filling and pouring aperture has been designed to avoid spillage when dispensing even very small quantities of the contents. Screw caps giving a re-sealable closure are of high density polythene incorporating a flange giving a positive, leak-proof seal.

After use, the composite container is easily disposed of by incineration

A 5 gallon size is immediately available and shortly a range of sizes. including some specifically designed for export purposes, will be introduced.

The Railway Clearing House has given full approval of the composite container for the carriage of goods classified by them as non-dangerous. For the carriage by rail of dangerous goods, full information must be submitted so that the need for tests can be considered.

Cyanamid Fit Production To Markets

Cyanamid have announced further marketing developments to meet the particular needs of its customers and their requirements throughout the world. In the United Kingdom, Cyanamid of Great Britain Limited, said that a team under Dr. Eric London was at present engaged in process development and in improving production techniques at the company's Gosport plant for the British and certain export markets served from there. This development group would expand in the future to adapt and test the company's products, especially in agriculture.

In the United States, Managing Director, Mr. E. G. Hesse pointed out that Cyanamid had long ago recognised that it could not engage in international business only as an adjunct to its domestic operations and said, "In the agricultural field, for instance, it is important for us to continue to develop new insecticide formulations to combat insects not indigenous to the United States. Further, many pharmaceutical preparations have to undergo changes to be acceptable in different countries."

Restrictions On Sugar Beet Cropping

Wider powers have been given to County Agricultural Executive Committees to prevent the spread of beet eelworm and to control the degree of infestation in land where eelworm already exists.

Under the new Order made by the Minister of Agriculture, Fisheries and Food, which replaces the existing Order, Committees may serve notices defining infested land on which crops likely to encourage an increase of beet eelworm may not be grown except under licence from the Committee. They may also prohibit the sale for planting of plants and potatoes grown in infested land, instead of only potatoes as previously, and may apply these cropping and other restrictions to allotments and private gardens where plants are grown for sale for planting.

The new Order also empowers Committees to free from cropping restrictions land in which the eelworm population has been sufficiently reduced.

As a result of the Order land in the parishes of Hockwold (Norfolk) and Burwell (Cambridgeshire) and the Grantham and Lincoln Sewage Farms have been added to the areas included in the Schedule of Infested Areas. In these areas restrictions are imposed on the growing of host crops of beet eelworm whether or not eelworm has been found on the land. The parish of Crowland in Lincolnshire (Holland) and four sewage farms have been deleted from the Schedule.

Beet eelworm attacks not only beet and related crops but also cruciferous crops (brassicas, etc.) on which the eelworms are equally capable of multiplying in the soil, usually without any obvious crop symptoms. The susceptible or host crops include sugar beet, fodder beet, mangolds, red beet, spinach beet, cabbage, kale, cauliflower, broccoli, brussels sprouts, turnip, swede, rape or coleseed (including turnip, rape and swede rape), mustard, cress, radish and kohl-rabi.

Beet eelworm was first found attacking sugar beet in this country in 1934. The danger to the English beet sugar industry was emphasised by the disastrous experiences in Germany, where continuous cropping with sugar beet produced such heavy beet eelworm infestation that crop yields diminished almost to nothing over large areas and many beet sugar factories had to be closed. To prevent a similar disaster in England, action was taken first by the British Sugar Corporation through their contracts with growers and later by the Minister of Agriculture through the Sugar Beet Eelworm Orders of 1943, 1950 and 1952.

Copies of the Order (S.I. 1960 No. 2147, the Beet Eelworm Order, 1960) may be obtained from H.M.S.O. or from any bookseller, price 4d. (by post 6d.).

Rabbit Control

Rabbit control authorities from all States of Australia and representatives of primary producer organisations met recently to plan the next moves in the battle against rabbits. The virus disease, myxomatosis, has reduced rabbit numbers to relatively low levels in many areas of Australia, but emphasis has now switched to poisoning, which is the most economic method of control now available.

The Australian C.S.I.R.O. has conducted much research on the behaviour of the rabbit, the nature of poisoning materials and the effectiveness of various baits and baiting methods.

However, rabbit control measures have tended to lag behind the technical know-how acquired through research. The recent conference aimed at an exchange of views not only on technical aspects but also on the economic, legal and sociological problems involved in containing the rise in rabbit numbers.

Pestcure Merger

Mr. E. H. B. Boulton has merged his Pestcure Company with Woodworm & Dry Rot Control Ltd., the largest specialist firm in the U.K. providing a service against timber decay.

Well known for his forthright speaking Mr. Brooke Boulton is President and Fellow of the Institute for Wood Science and for over thirty years has been well known to the architectural profession both as a consultant and lecturer on timber preservation. He also serves on many committees of the B.W.P.A. and has given frequent talks on the BBC.

"Brookie" as he is affectionately known, first became attracted to the study of timber diseases shortly after his return from the first world war. Later he went to Cambridge to study forestry and remained there for fourteen years as a University lecturer in Forestry and Timber Utilization. During this time he carried out a great deal of work on the habits of wood-boring insects and wood rotting fungi.

In 1934 he became Technical Director of the Timber Development Association and fourteen years later formed his own timber servicing company, namely Pestcure Ltd. and developed his own range of preservation products.

No doubt Mr. Brooke Boulton's personality and reputation as a practising authority led to Pestcure being engaged to treat many famous buildings threatened by timber decay. Coventry Cathedral, Longleat, Stoneleigh Abbey and Drumlanrig Castle head a very impressive list of premises at which he has worked. He is also the Admiralty appointed Consultant to *H.M.S. Victory*.

By joining forces with Woodworm & Dry Rot Control Ltd., members of the Rentokil group, Mr. Brooke Boulton will be relieved of the constant battle of commercial endeavour and will be able to follow, what we suspect to be his natural bent, a more technical approach to the problem of timber decay using his knowledge and experience to concentrate on the many unusual and complicated problems which may arise when dealing with preservation of timber.

To quote his own words at the reception in the House of Commons given to announce the merger, he will be able to "get back to the microscope" an aim in which he will be ably assisted by the facilities at Woodworm & Dry Rot Control's well equipped modern laboratories. Mr. Boulton's considerable teaching and lecturing ability should provide a valuable asset to his new colleagues for both internal and external education.

The clients of Pestcure Ltd. will still be able to receive Mr. Boulton's personal attention when required but in addition will have the benefit of immediate "on the spot" attention from the local offices of Woodworm & Dry Rot Control Ltd.

Seed Dressing Dangers

Following a meeting between representatives of the Nature Conservancy, National Farmers' Union, Country Landowners' Association, National Association of Corn and Agricultural Merchants, the Association of British Manufacturers of Agricultural Chemicals, D.S.I.R. (Laboratory of the Government Chemist), Department of Agriculture for Scotland and the M.A.F.F. to exchange views on the evidence of the dangers of seed dressings to wild life, and to explore possible means of minimising undesirable effects it was agreed that :—

(a) Seed dressings play a very valuable part in agricultural production ;

(b) Not all seed dressings present a hazard to wild life ;

(c) There is evidence that seed dressings containing dieldrin, aldrin, and heptachlor, which in other respects are particularly valuable in present circumstances, can kill birds that eat dressed seed ; and there is strong circumstantial evidence that deaths occur from this cause, particularly when sowing conditions are difficult ;

(d) There is also some evidence that deaths of foxes and other predators may have occurred through eating birds that have died through ingesting these chemicals.

It was agreed that further experimental work will be done. Arrangements have already been made for collaborative experimental work by the Ministry of Agriculture, Fisheries and Food and the Laboratory of the Government Chemist, including examination of a limited number of bodies of birds and foxes that will be sent in by the Ministry's Pest officers after an investigation of local circumstances. Collaborative research will continue between the manufacturing companies and the Ministry of Agriculture, Fisheries and Food.

Publicity will be arranged by the Ministry and all parties concerned so as to warn farmers about the risks to wild life ; warning against illegal spreading of poisoned grain, referring to the Protection of Birds Act, will be included ; this publicity will also draw attention to the care needed to dispose of any surplus treated seed and will warn against mixing it with untreated seeds or feeding it to livestock. The advice issued by the manufacturers, with the dressings or dressing plants, will be modified so as to ensure that wheat bulb fly dressing is employed *only* where and when there is a real need to use it to control this pest. Seed merchants and manufacturers of dressings will continue to warn users of the risks from dieldrin, aldrin and heptachlor dressings, and draw attention to the *extra* risk from the higher dosage of insecticide ; thereby to enable landowners and others to use their judgement more critically than hitherto when deciding on the choice of dressing.

The Departments undertook to view the whole position after the Spring of 1961 when further information should be available.

Red Boll-worm Hampers Cotton Growing

Cotton growing in Southern Rhodesia has a great future and according to Professor E. B. Edney, Department of Zoology, University College of Rhodesia and Nyasaland, there was no reason that it should not become as equally important as the tobacco crop—provided that pest problems are overcome.

Professor Edney said that within the next three years his department hoped to have "some of the answers" to the problem of the red boll-worm of cotton that, in its caterpillar stage, wreaked havoc among the young cotton and helped to make cotton growing on a large scale uncommercial in the Colony in the past.

A recent composite grant to the University College of £10,700 made by the Federal Government, the

Nyasaland Agricultural Produce and Marketing Board, the Nyasaland Government and the Colonial Development and Welfare Fund, will enable research to be undertaken on this insect pest.

Termite Control With Aldrin

In the second part (dealing with research) of the 1959 Annual Report of the Department of Agriculture for Tanganyika, it is stated that in a number of areas in Tanganyika termites do much damage to growing crops, and crops at harvest time. However preliminary results from experiments show that applications of aldrin, either mixed with a fertilizer or used in seed dressings appear to be a promising method of control.

Action Against Aphid Borne Diseases

In the 1959 growing season, the spread of aphid borne potato viruses throughout most of England was substantially greater than usual and as a result, the health of many seed potato stocks for 1960 planting was below average. Concern has been expressed by both growers and seed potato traders that as conditions favoured a further exceptional spread of virus infection throughout the spring and early summer of 1960, this will have a serious effect upon the health, and therefore the yielding capacity, of much of the potato seed from the 1960 crop.

The increased number of preventive measures against aphids taken by growers in 1960 may prove these fears to be exaggerated. Nevertheless, in view of the widespread increase in potato virus disease in 1960 it is recommended that the use of only certified seed, particularly in the eastern half of the country, will do much to reduce the risk of infection in 1961 and will go far to prevent any marked decline in the yield and health of ware potatoes. Growers in the eastern half of the country who may be in doubt about the health of their once-grown stocks of seed potatoes should replace them with certified seed potatoes.

The importance of sowing seed potatoes of the highest quality cannot be over-emphasised in any year, but in view of the circumstances prevailing in 1960, growers are well advised to take no unnecessary risk when planting their 1961 crop.

The cost of certified seed is inevitably higher than that of once and twice grown seed, but the additional expense will undoubtedly be offset by the higher yield which can be expected from such seed potatoes, following a year in which potato seed crops generally were exposed to widespread leaf roll and other potato diseases.

D.S.I.R. Require Research Films

The Department of Scientific and Industrial Research has set up a Working Party to consider national needs in the field of scientific film. It is especially interested in the aspects of film as a research tool and in communicating research results.

The membership of the Working Party, which is under the Chairmanship of Dr. W. L. Francis, is :- Mr. Edgar Anstey, British Transport Commission, President of the Scientific Film Association ; Mr. H. E. Beckett, Head of Information Division, D.S.I.R. ; Mr. D. E. H. Densham, Ministry of Aviation ; Sir Arthur Elton, Associated Electrical Industries ; Mr. C. Engel, Medical Illustration Department, Guy's Hospital ; Prof. G. E. H. Foxon, Guy's Hospital, President Brit. Universities Film Council ; Mr. L. E. Hallett, Royal Photographic Society of Great Britain ; Mr. L. Poole representing D.S.I.R. ; Prof. C. H. Waddington, Institute of Animal Genetics, Edinburgh, Mr. R. E. Overbury, D.S.I.R. (Secretary).

To assist the Working Party the Department, in co-operation with the other Research Councils, the Atomic Energy Authority and some Government Departments, is circulating a questionaire to industry, universities and research organisations.

In this way it is hoped to reach all those engaged in the serious use of film in this field ; who hold stocks of interesting research film or who have developed unusual techniques and applications.

Anyone who can contribute to this enquiry, but who has not received the questionaire, is invited to contact the Information Division, Department of Scientific and Industrial Research, 14-18 Cornwall Terrace, N.W.1. (HUN. 1212, Ext. 752).

East African Pesticides Control Scheme

Dangers from the use of insecticides — some £800,000 worth are imported into East Africa each year — may be controlled by a Pesticides Council which will administer a compulsory control scheme and a trained staff including mobile teams to work in the field. The scheme has the backing of the East African territorial Directors of Agriculture and Veterinary Services, health authorities, and the pesticides industry. The proposals were endorsed at a recent meeting at Muguga, near Nairobi, at which the Chief Administrative Secretary of the East Africa High Commission, Mr. H. L. Adams, was in the chair.

Entomologists in East Africa discussed the idea of control of pesticides two years ago from the agricultural view point, and medical men have since agreed there is need for control in the medical field, with pesticides being used more and more by primitive peasant-farmers in remote areas where medical aid and facilities are limited.

The £25,000 unit to be set up would have a director with scientific training, an analytical unit which would check the chemical make-up of approved pesticides, and several small, mobile teams to carry out field trials of pesticides in the territories. One team would deal with the toxicity of pesticides, pin-pointing in the field hazards to people using toxic chemicals, as well as possibly later dealing with the problems of residue from insecticides ; other teams would work on insecticides and herbicides.

Among arguments for the control scheme there was the possible effect on the East African economy of the banning, by countries such as America and Germany, of coffee which might be affected by the residue from pesticides. In their discussions on the proposed control scheme, the experts agreed on the need for uniform legislation, and for guarantees of analysis and composition of pesticides, precise statements of the pests they claimed to control, and conditions under which toxic chemicals could be used.

Dr. R. de B. Ashworth, of the British Ministry of Agriculture, Food and Fisheries, who has been advising the experts on a control scheme, is to make a final report to the Colonial Secretary, after which the proposals will be considered by the E.A. Governments. However, before the scheme can operate, the East African legislatures will have to pass enabling acts to bring the Pesticides Council into operation, or create a body which would operate on an East African basis under the High Commission.

Pneumatic Sprayers

The Editor, Pest Technology.

The paper entitled "Pneumatic knapsack sprayers for use in storage premises" (*Pest Technology* **3** (1) 12-15, *October* 1960) should have included the information that the overall capacity of the standard pneumatic sprayer used in the tests was 2.5 gal. The published results must, of course, be considered in the light of the air/liquid ratio of the machine and the maximum working pressure prescribed by the manufacturer which, in this instance, was 75 lb per sq. in.

It has rightly been pointed out to us that the restricted description given in our paper does not enable the reader to appreciate that the performance of the standard pneumatic sprayer we used could be bettered by sprayers having higher air/liquid ratios and greater working pressures. Some such sprayers are available on the market and when fitted with a suitable pressure-regulating valve, should be able to give a constant output rate of liquid at 30 lb. per sq. in. nozzle pressure until the container is empty.

G. T. Bills, A. A. Green.

Pest Infestation Laboratory Slough.

Free Woodworm Survey

Woodworm and Dry Rot Centre have announced that with the expansion of their surveying facilities, it is no longer necessary for the company to make any charges for a woodworm and dry rot survey. Until now a survey fee of five guineas has been charged.

The free survey includes a detailed technical report and recommendations so that the property owner knows exactly the location and the extent of the damage and to what extent treatment is necessary.

As the problem of woodworm and dry rot often arises during the exchange of properties when the purchaser has to meet various fees and expenses the chance of a free timber decay survey should be most welcome.

Comments from the U.S.

"The development of more effective pesticides is one of the reasons why it takes only twelve per cent. of our population to produce food, clothing and shelter for the remaining eighty-eight per cent. . . . who are free to engage in activities to provide the highest standard of living for all of us." — *Congressman J. L. Whitten.*

"Except for the antibiotics, there are probably no materials that protect the world's people against more diseases than do the chloronated hydrocarbon insecticides." — *Dr. Henry van Zile Hyde. Division of International Health Public Health Service.*

"Impartial scientific and public bodies have found that pesticides are necessary to protect the nation's food supply and public health and can be wisely and safely used.

The factual avidence is overwhelmingly on our side and we should welcome any opportunity to tell our story. When and where we've had the chance and done so, we have never regretted it." — *Jackson V. Vernon, President of the N.A.C.A.*

The above are quotations from the National Agricultural Chemicals Association (of America) 27th Annual Meeting.

Pyrethrum at Kenya's Royal Show

The growing importance of pyrethrum in the Kenyan economy is reflected in the large Pyrethrum Board of Kenya exhibit at this year's Royal Show in Nairobi.

Pyrethrum is one of Kenya's main cash crops — and the exhibit shows how European and African farmers can raise their pyrethrum profits without increasing the area of land under cultivation. The display is named 'Gold at Your Feet" — the gold being the 50 sovereigns per acre which the Board estimates can be added to the pyrethrum cheque by really efficient farming.

The methods which the Board favours, and which can make the difference between 400 and 800 lbs. per acre, include careful planting, general supervision of cultivation and the replacement of weak plants by healthy speciments.

The selection of strains especially suited for the area, with the highest possible pyrethrin content is another important factor in good pyrethrum farming — and one which the Board encourages by developing new specialised breeds at its research station at Molo.

New Face Shield

Safety Products Ltd. have introduced a newly designed "Clearways" face shield that is said to satisfy all practical and aesthetic conditions.

It consists of a headband and brow guard with detachable flip-up vizor, which fits lightly and easily on the head, the correctly placed headbands distributing the few ounces of weight evenly and with no distracting pressure or tension.

The headband, made from lightweight fibre, has an easily adjustable elastic loop at the back and the usual leather sweat band has been superseded by a cheaper, more comfortable and hygienic replaceable self-adhesive band of urethea.

The plastic brown guard and detachable visor is made of non-inflammable "Celastoid". The detachable clear vizors have a rigid aluminium edge binding for added strength and shape retention. They are fitted by press fasteners inside the brow guard, to prevent liquids running down the rear of the vizor.

They extend well back along the sides of the face and will swivel up from the face as required. Three depths, i.e., 4", 6" and 8" respectively and are available in two thicknesses of either .030 or .040 inches. An alternative colour of green is available as is also an eye level colour insert of green, smoke or blue.

The shield is said to have applications in factories, workshops, laboratories and chemical works, technical schools and for woodworking, metallurgy, engineering, municipal works and building, breweries and soft drinks manufacturers, crop spraying and agriculture.

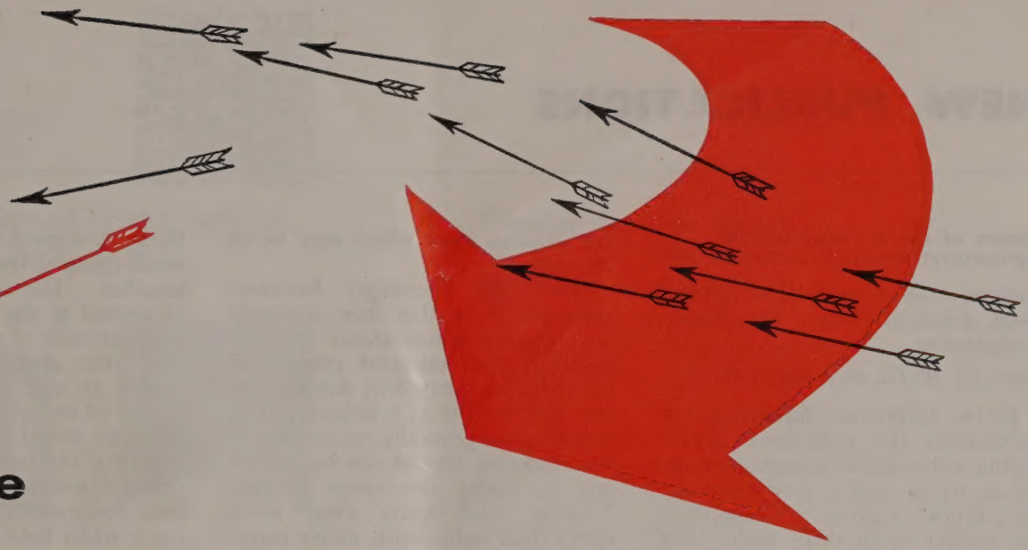
Prices range from 16/- each and further particulars may be obtained from Safety Products Ltd., Holmethorpe Avenue, Redhill, Surrey.

N.A.A.S. Appointments

Mr. W. S. Gibson, B.Sc. (Agric.), Regional Director of the National Agricultural Advisory Service, East Midland Region since 1951, retired on 30th November last.

Mr. Gibson will be succeeded by Mr. R. B. Ferro, N.D.A., at present Assistant to the Senior Advisory Officer (Agriculture) in London.

Mr. N. F. McCann, B.Sc., N.D.A., at present Deputy Regional Director of the East Midland Region, will succeed Mr. J. W. Reid, O.B.E., N.D.A., F.A.C., as Regional Director, Yorks and Lancs. Region on 1st March, 1961. It was announced in October that Mr. Reid would succeed Mr. W. E. Jones as Senior Advisory Officer (Agriculture).



a killer you don't have to handle with care

SEVIN Insecticide—a new kind of pesticide—Powerful Enough to Kill Resistant Insects, Yet Safer to Handle than DDT.

Years of Union Carbide research has developed a new kind of insect killer, SEVIN Insecticide, that is chemically different from any other insecticide now in commercial use. SEVIN is a powerful carbamate and has proved highly effective against fruit and vegetable insects, forest and ornamental pests, animal ticks and lice—*even those insects that have developed resistance to other insecticides.*

SEVIN Insecticide potency lasts longer in the field and fewer sprayings are required to do an effective job. SEVIN appears less toxic to humans and animals than DDT. Field workers can continue operations immediately after a SEVIN spraying.

SEVIN has no objectionable odor and is compatible with most other chemicals so you can combine a complete insect control program in one formulation.

Find out how SEVIN can help you control insect damage and improve the quality of your crops. Write today for detailed information CPT 1 to the Chemicals Department, Union Carbide International Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y., U. S. A., Cable Address: UNICARBIDE, New York.

PHYSICAL PROPERTIES: CHEMICALLY PURE 1-NAPHTHYL N-METHYLCARBAMATE IS CHARACTERIZED BY:

appearance	white, crystalline solid
odor	essentially odorless
melting point	142 deg. C.
vapor pressure	less than 0.005 mm. Hg at 26 deg. C.
density	1.232 at 20/20 deg. C.

UNION CARBIDE
TRADE MARK
Chemicals

NEW PUBLICATIONS

Report of the 1st International Agricultural Aviation Conference 1959

Published by International Agricultural Aviation Centre, The Hague, Netherlands.

Price £2. 10. 0d. or 7 dollars (U.S.)

In the leaflet accompanying this publication the publishers say:—"This voluminous report well deserves to be called a manual for agricultural aviation, all aspects of the subject being dealt with. For example, the biological basis of aerial agriculture — orchard spraying with aircraft — review of materials for aerial application — invert emulsions — the drift hazard — droplet size and recovery of sprays— spraying weeds from the air — aircraft: the operator's requirements— requirements for an agricultural helicopter — distribution equipment — the distribution of granular fertilisers from light aircraft — rotary atomisers — international airworthiness requirements for agricultural aircraft —corrosion by agricultural chemicals in airframes and equipment — economic factors affecting agricultural aircraft operations — toxicological aspects: safety precautions— techniques of low flying and flight safety — the causes of accidents in agricultural aviation — meteorological aspects of agricultural aviation —ground organisation—beaconing.

"All these subjects are treated by the most competent experts, while moreover all discussions, following the reading of the different papers, are included in this report."

The publishers conclude that this publication is in fact a manual which nobody who is either directly or indirectly concerned with agricultural aviation can afford to do without.

Those who attended the conference will remember a somewhat chaotic three days during which the mass of facts, figures and opinion left the mind reeling. This report will allow each paper to be given the care and consideration deserved. In this context we cannot resist the following quote from G. S. Hartley's paper "The Physics of falling droplets". Mr. Hartley says:—

"It is pointed out that the more obvious factors are often opposed by less obvious ones which may be as important."

After this seemingly harmless statement the author then expounds an argument which shows that the generally recommended procedures for reducing spray drift damage are not quite so true as is believed. For example it is generally recommended that spraying should not be carried out in windy conditions because "strong winds carry away more spray than light winds under inversion conditions" and are thus, under the accepted tradition, likely to cause more damage, "but" says the author, "what is carried away is less likely to fall anywhere in high concentration" and thus in fact is liable to cause *less* spray drift damage.

This argument does not only apply to aerial spraying but also to ground spraying. Several of the other papers also deal with problems which are of fundamental importance to crop spraying as a whole, so that the book can be recommended to spraying manufacturers, contractors and technologists generally. Come to that the chemical manufacturers may find the book well worth having on their book shelves.

Biological and Chemical Control of Plant and Animal Pests

Edited by L. P. Reitz.

Published by the American Assoc. for the Advancement of Science, Washington, D.C. Agents in the U.K. Bailey Bros. & Swinfen Ltd. London, W.C.1. Price 52/-

This publication is compiled of the papers presented by Section O in Agriculture at the Indianapolis meeting of the American Association for the Advancement of Science, 1957.

The papers are grouped under three main headings — namely, The Public's Stake in Pest Control, Recent Advances in Chemical Control and Biological Control of Pests, —with a number of authors contributing to each section.

The papers are typical of meetings which are arranged to cater for an attendance ranging from interested laymen to qualified scientists and vary in style, quality and quantity. Also typical is the fact that section three, Biological Control, is given as much space as the other two sections together. The optimistic approach of several of the authors is also the usual attitude of such papers.

In view of the original audience aimed at one cannot expect the wealth of technical and scientific detail that would be given in say the report of the 1st International Agricultural Aviation conference. However, being easier to read, and covering a wider field it is liable to be of interest to the student or those specialists who like to know briefly and generally the developments in other fields. Rather than being regarded as a textbook or reference this book should be considered pleasant, interesting but not absolutely essential reading.

Technical bulletins and leaflets

Collection and Storage of Ash, Sycamore and Maple Seed. Forestry Commision leaflet No. 33 available from H.M.S.O. London, Price 9d.

Vapam Leaflet No. 510 briefly describes the properties of Vapam (sodium methyl carbamate) its uses and methods of application for glasshouse and indoor use. Precautions to be taken are also given. Available from Pan Britannica Industries Ltd., Waltham Abbey, Essex.

Malthexo Dust. single page information sheet indicating the rate of application of this 4% Malathion formulation for the control of Sciarid and Phorid mushroom flies. Available from Pan Britannica Industries.

Control of Cattle Lice: written by W. O. Haufe this ten page bulletin deals with the identification, life histories, distribution, habits and methods of controlling cattle lice. Mainly aimed at the Canadian livestock owner it is available from the Information Division, Canada Dept. of Agriculture, Ottawa, as publication 1006.

Ants and their control in Canada: a five page pamphlet dealing with the life history, habits and control of ants both in and out of doors. Available from the Information Division, Canada Dept. of Agriculture, Ottawa as publication 1055.